Self-Calibrating Greenhouse Gas Balloon-Borne Sensor

Southwest Sciences, Inc.

Technical Abstract

Understanding the sources and sinks of carbon dioxide and other greenhouse gases has been recognized as critical to predicting climate change and global warming. A variety of research studies funded by DOE, NSF, NASA and NOAA to measure the fluxes and fluctuations of CO2 profiles throughout the troposphere and lower stratosphere have provided a great deal of useful information, but the instrumentation used has been restricted to airplane or large stratospheric-type balloon gondola platforms where a few measurements are very expensive. We propose a new approach where low cost, extensive measurement campaigns can be made using standard meteorological balloons. In this SBIR program, Southwest Sciences is developing a lightweight, inexpensive greenhouse gas sensor suitable for balloon sonde measurements, Using a novel measurement technique, this sensor will provide dry air mixing ratios of CO2 without the need for concurrent measurements of temperature, pressure or moisture. The Phase 1 research successfully demonstrated the viability of this approach and in Phase 2, a prototype sensor will be built and field tested in a series of balloon-sonde flights.

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2008 Phase II
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A Miniaturized UV/VIS/IR Hyperspectral Radiometer for Autonomous Airborne and Underwater Imaging Spectroscopy of Coastal and Oceanic Environments

Opto-Knowledge Systems, Inc. (OKSI)

Technical Abstract

The AquaScan, a miniaturized UV/VIS/NIR hyperspectral imager will be built for deployment on a UAV or small manned aircraft for ocean coastal remote sensing applications. The hyperspectral system includes a data acquisition system with remote operation capability proving a real-time waterfall display of the hyperspectral scans. OKSI teamed with Scripps Institution of Oceanography to define and design a sensor that explicitly meets the performance requirements needed for ocean remote sensing of coastal regions, but can also be used for terrestrial remote sensing. Specifically, some key requirements called for: 1) high spatial resolution (< 1 meter), 2) high spectral resolution (< 10 nm), UV □ NIR coverage (300 □ 1000 nm), 4) high sensitivity for low reflectivity of ocean surfaces, 5) provide simultaneous downwelling solar radiation measurements, and 6) allow for operating mode that avoids specular reflections off ocean surface. The AquaScan design was completed during the Phase I effort. During Phase II the sensor will be manufactured, tested, calibrated, and prepared for flight testing. The system will then be demonstrated during several airborne tests off the Southern California coast. The tests will include measurements of spatially/spectrally unique ocean phenomena including red tide blooms and river plume run-offs after heavy rain storms. Coordinated ship-based remote sensing and in situ measurements will take place concurrently with the newly developed miniature UV/VIS/NIR airborne measurements. The ship-based measurements will serve as ground truth for validation/verification. In addition, OKSI will attempt to coordinate data collections with satellite passes (e.g., MODIS, MERIS, SeaWiFS). Comparison with satellite data will serve as validation and demonstration of the capability to support future satellite programs (e.g., GEO-CAPE).

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